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An Evaluation of the Trout Population
in Three Sections of the Musselshell River
Near Deadman's Basin Reservoir.

Montana Department of Fish, Wildlife and Parks
by Mike Vaughn and Wade Fredenberg

June 1984

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An evaluation of the trout population in



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Abstract

Deadman's Basin Reservoir is currently being evaluated by the Montana Department of Natural Resources and Conservation (DNRC) as a possible site for hydropower generation. Operational demands could alter flows in 38 miles of the Musselshell River and may impact water levels in Deadman's Basin Reservoir. Population estimates for brown trout were obtained in three sections above and within the affected reach of the river. The estimated brown trout population was 116 per mile in the upper section and 34 and 35 fish per mile, respectively, in the two lower sections.

The Musselshell River in this area has many factors potentially limiting trout abundance. Foremost among them are dewatering, degraded channel configuration and excessive siltation. Some brown trout reproduction may occur, but many of the resident brown trout are probably immigrants to the area from upstream. Brown trout examined were in fair to good condition and specimens to 5 1/4 pounds were captured. The potential exists in this reach of stream for increased brown trout populations with improved instream flow conditions.

Introduction

Deadman's Basin Reservoir is an off-stream storage site in the Musselshell River valley on the eastern edge of Wheatland County. Water for the reservoir is diverted from the Musselshell River above Shawmut, and return flow enters the river either at Barber directly south of the reservoir or further downstream via Careless Creek. The reservoir is currently being studied by the

DNRC for the possible addition of a hydroelectric power generation facility. The DNRC contracted with the MDFWP for this analysis of the existing fishery in those sections of the river that may be affected by changes in withdrawals and return flows dictated by power generation needs. The major objectives of this investigation were:

- 1) To obtain population estimates for brown trout in three sections of the Musselshell River.
- 2) To evaluate the status of existing populations in relation to the stream's potential and identify probable limiting factors.
- 3) To predict the impact on existing populations of potential changes in the flow regime.

Description of the Study Area

The Musselshell River drains an area of approximately 8,000 square miles in central Montana with headwaters in the Crazy, Castle and Little Belt mountains. The headwaters support good populations of naturally reproducing brown and brook trout. The river flows easterly and then turns northerly to empty into Fort Peck Reservoir some 364 miles from its headwaters. The trout fishery declines below Harlowton and is gradually replaced by a warm-water fishery.

The upper study section was just above the Deadman's diversion on the Winnecook Ranch east of Harlowton (53 river miles below the junction of the North and South forks of the river near Martinsdale). At this point the river produces a fair-to-good trout fishery. The middle study section was located on the OK

Bar Ranch 14 river miles below the Deadman's diversion. The lower study section is located downstream from the proposed power plant on the Ecklund Ranch which is immediately downstream from the bridge at Barber. The river here also supports trout, but is beginning to enter the transitional zone between the cold-water fishery above and the warm-water fishery of the lower river.

Methods

All fish were collected by electrofishing. A small plastic boat was used to transport a 3500-watt generator in conjunction with a Coffelt VVP-15 shocking box. The negative electrode was fixed to the boat. The positive electrode was a mobile probe capable of randomly working the water or selectively working trout habitat.

Sampling on all three sections was done during April of 1984. Valid estimates were obtained in all three sections for brown trout. Five marking runs and four recapture runs were needed to complete these three estimates. A total of 134 brown trout were sampled. Lengths and weights of all brown trout were recorded and scale samples taken. Estimates of numbers and biomass were calculated, using a computer program. The formula used was as follows:

$$N = \frac{(M + 1)(C + 1)}{(R + 1)} - 1$$

Where: N = population estimate.

M = number of fish marked.

C = number of fish caught in the recapture sample.

R = number of marked fish caught in the recapture sample.

Results

Winnecook Ranch Section - 7,100 feet

Brown trout estimates on the Winnecook Ranch section were 116 fish/mile with a biomass of 88 pounds/mile. Brown trout aged from scale samples averaged 4.6, 9.3, 10.9, 13.7, 15.7 and 20.2 inches long for age groups 1 through 6. The largest brown trout sampled was 23.3 inches and weighed 3.18 pounds. Average condition factor for 5-inch and larger fish was 32.72.

OK Bar Ranch Section - 8,300 feet

Estimates for brown trout on this section were 34 fish/mile with a biomass of 30 pounds/mile. Aged fish averaged 4.7, 10.3, 12.5, 14.6, 20.0 and 23.5 inches long for age groups 1 through 6. The largest brown trout sampled was 23.4 inches and 5.25 pounds. Average condition factor for 5-inch and larger fish was 33.09.

Barber Section - 6,700 feet

Brown trout in the Barber section were estimated at 35 fish/mile and biomass at 33 pounds/mile. Aged fish averaged 5.4, 10.9, 12.0, 14.0 and 15.1 inches for age groups 1 through 5. The largest brown trout sampled was 16.6 inches and weighed 1.71 pounds. Average condition factor for 5-inch and larger fish was 35.52.

Other Species

Other than brown trout, the only game fish seen were occasional mountain whitefish in the upper section at the Winnecook Ranch. The most common nongame fish in the three study sections were white suckers and longnose suckers. Other nongame fish found in the study area were mountain suckers, shorthead

redhorse, longnose dace, Hybognathus spp., Flathead chubs, carp and stonecats. Most of these fishes are common in eastern Montana streams. Numbers of nongame fish were not compared between sections.

Discussion

The Musselshell River in the study area has numerous trout habitat problems which contribute to low populations. These include eroding banks; siltation; stream channel alterations; lack of riparian vegetation; long, wide, shallow riffles and long, deep, pond-like pools with little cover; dewatering and irrigation abuses and marginally-high water temperatures. Brown trout in the Musselshell were found during this investigation wherever a moderately strong current adjoined appropriate cover. Cover included undercut banks, rock structures, brush, logs, or in some cases, merely deeper water.

Given enough instream flow, the river in this stretch appears to have the potential of supporting a good brown trout fishery. The Winnecook section above the Deadman's diversion has about three times the number of brown trout seen in either of the two lower sections. Brown trout numbers in the lower two sections were essentially identical.

The trout that were sampled appeared to be healthy. Condition factors of the brown trout collected were good considering that the fish had recently overwintered. This water has the capability to grow large, even trophy-sized, fish. Two brown trout in excess of 3 and 5 pounds were caught during electro-fishing.

Age 4 fish seem to be predominant in populations from all three study sections. Of all fish that were aged, brown trout from the year class spawned in the fall of 1979 (Age 4) made up exactly 50% of the total. Presumably, they also comprised about half the population. If some combination of factors (such as low water with high temperatures) had decimated the brown trout populations before the spring of 1980, those fish from that year class may have benefited by reduced competition from other age classes. Some analysis should be made as to why conditions apparently were favorable for more successful reproduction and recruitment of this 1980 age class.

Reproduction appears to be marginal in this reach of the Musselshell River, even above the diversion. Siltation of potential spawning sites and/or low fall water levels are the most likely reasons. In this situation, spawning success may be very erratic from year to year. The river further upstream above Harlowton contains a healthy reproducing brown trout population. It is likely that immigration from reproduction occurring upstream maintains the trout population in the study area to a large extent.

Recommendations

Any further water withdrawals from the Musselshell River for Deadman's Basin would have negative impacts on the present marginal trout population below the diversion. Present trout numbers are low, but it is likely that improved flow year-round would result in increasing trout populations. Even with current flow rates, numbers of trout would probably increase dramatically

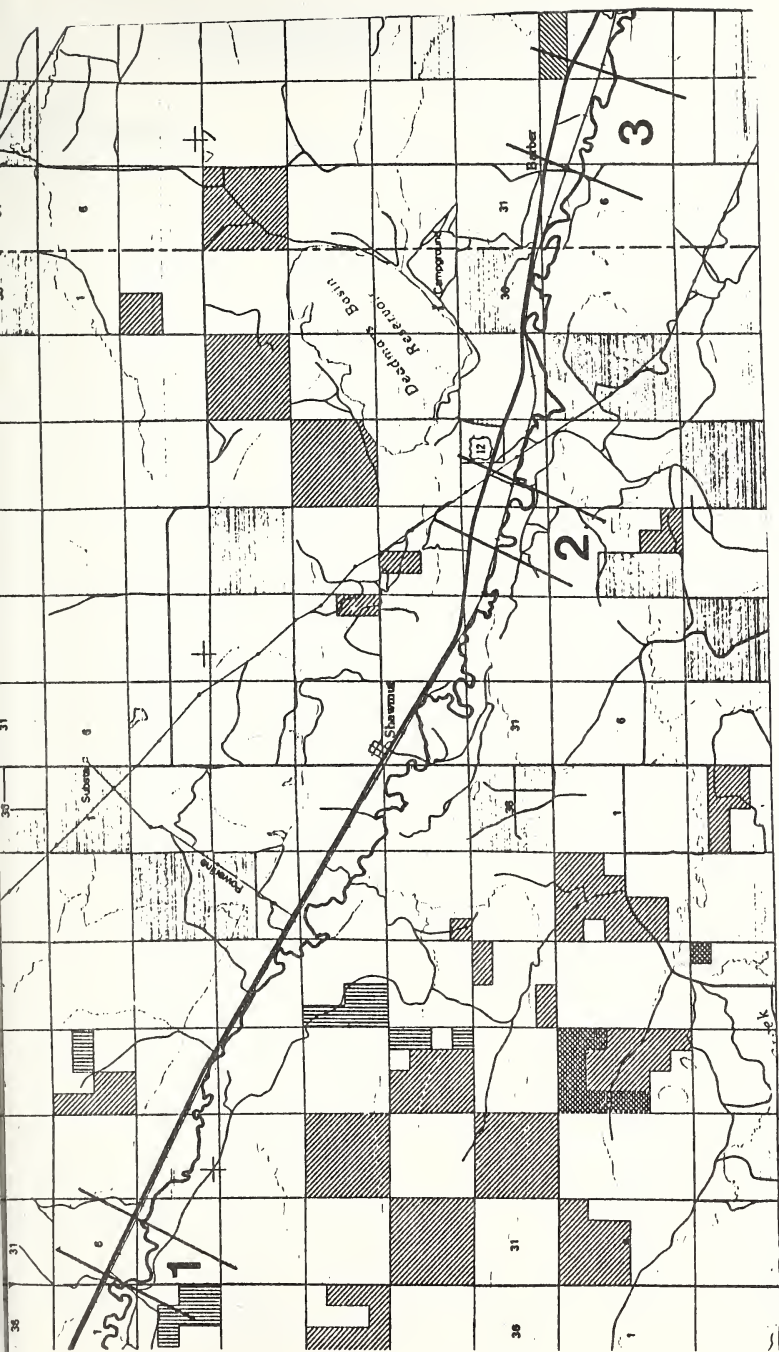
with rehabilitation of the river channel, its banks and the riparian vegetation.

The middle section of river between the Deadman's diversion and proposed power outfall has the potential to develop into a decent trout fishery. It appears that this section of river would be for all practical purposes sacrificed in terms of potential fisheries if the amount of water diverted into Deadman's Basin is increased substantially. At the present time, there are periods of almost total dewatering already occurring here.

The section below Barber could benefit from additional water via the power return flow from Deadman's Basin. However, if total dewatering of the middle section of the study area occurs, the trout population in the lower section may not increase as expected. Reproductive potential is especially poor here and this reach may be very dependent on immigrant fish from upstream. A dewatered buffer zone would act as an immigration barrier. Bypass flows that are no less than what presently occur are a must. Furthermore, attempts to improve the fishery in the river reach below the power outfall by increasing flows would only produce positive results if assurances were made that the additional instream flow is kept in the stream and not diverted for irrigation or other purposes.

In conclusion, it is obvious that the trout fishery of the Musselshell declines downstream from Deadman's diversion. In part this is due to natural factors, but the biggest limiting factor appears to be lack of instream flow which results in the channel carrying such a low volume of water that trout habitat is

severely degraded. Any mitigative attempts to improve the trout fishery of the Musselshell River should be aimed first at improving instream flow conditions during critical periods, and secondly at improving water quality and habitat parameters. The mere presence of a 5 1/4-pound brown trout proves that the Musselshell River downstream from Deadman's diversion has potential to produce a good trout fishery, but currently the fishery status of this reach of the river can be considered only fair at best.



Appendix I - Map of the study area:

- Section 1 - Winnecook Ranch (7,100 feet)
- Section 2 - OK Bar Ranch (8,300 feet)
- Section 3 - Barber (6,700 feet)

MONTANA DEPARTMENT OF FISH WILDLIFE & PARKS

RPT 1189.1

FISH POPULATION MARK-RECAPTURE DATA

PAGE

MAY 10, 1984

MUSSELSHELL RIVER WINNECCK
COLLECTION 584001 004W BROWN TROUT7100 FEE
MARKED 04/12

| COLLECTION | SPECIES | TRIP | MARK | LENGTH | WEIGHT | AGE | SEX | OT |
|------------|---------|------|------|--------|--------|----------|-----|----|
| 584001 | 004W | 1 | 0 | 3.6 | .03 | 1 | | |
| 584001 | 004W | 1 | 0 | 4.1 | .04 | 1 | | |
| 584001 | 004W | 1 | 0 | 4.2 | .04 | 1 | | |
| 584001 | 004W | 1 | 0 | 4.7 | .04 | 1 | | |
| 584001 | 004W | 1 | 0 | 5.3 | .05 | 1 | | |
| 584001 | 004W | 1 | 0 | 8.5 | .22 | 2 | | |
| 584001 | 004W | 1 | 0 | 9.0 | .24 | 2 | | |
| 584001 | 004W | 1 | 0 | 9.4 | .26 | 2 | | |
| 584001 | 004W | 1 | 0 | 9.9 | .27 | 3 | | |
| 584001 | 004W | 1 | 0 | 9.9 | .34 | 3 | | |
| 584001 | 004W | 1 | 0 | 10.1 | .34 | 3 | | |
| 584001 | 004W | 1 | 0 | 10.2 | .35 | 3 | | |
| 584001 | 004W | 1 | 0 | 10.3 | .34 | 2 | | |
| 584001 | 004W | 1 | 0 | 10.4 | .34 | 3 | | |
| 584001 | 004W | 1 | 0 | 10.4 | .36 | 3 | | |
| 584001 | 004W | 1 | 0 | 11.9 | .55 | 4 | | |
| 584001 | 004W | 1 | 0 | 12.0 | .56 | 4 | | |
| 584001 | 004W | 1 | 0 | 12.3 | .58 | 4 | | |
| 584001 | 004W | 1 | 0 | 12.3 | .83 | 3 | | |
| 584001 | 004W | 1 | 0 | 12.4 | .70 | 3 | | |
| 584001 | 004W | 1 | 0 | 12.7 | .65 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.2 | .81 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.4 | .81 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.5 | .85 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.6 | .72 | 5 | | |
| 584001 | 004W | 1 | 0 | 13.6 | .76 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.6 | .80 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.6 | .80 | 4 | | |
| 584001 | 004W | 1 | 0 | 13.9 | .98 | 4 | | |
| 584001 | 004W | 1 | 0 | 14.0 | .97 | 3 | | |
| 584001 | 004W | 1 | 0 | 14.2 | .98 | 4 | | |
| 584001 | 004W | 1 | 0 | 14.2 | 1.07 | 4 | | |
| 584001 | 004W | 1 | 0 | 14.3 | 1.00 | 4 | | |
| 584001 | 004W | 1 | 0 | 14.3 | 1.12 | 4 | | |
| 584001 | 004W | 1 | 0 | 14.4 | .89 | 4 | | |
| 584001 | 004W | 1 | 0 | 14.5 | 1.00 | 5 | | |
| 584001 | 004W | 1 | 0 | 14.8 | 1.14 | 4 | | |
| 584001 | 004W | 1 | 0 | 15.5 | 1.13 | 4 | | |
| 584001 | 004W | 1 | 0 | 15.5 | 1.22 | 4 | | |
| 584001 | 004W | 1 | 0 | 15.5 | 1.28 | 5 | | |
| 584001 | 004W | 1 | 0 | 15.5 | 1.28 | 4 | | |
| 584001 | 004W | 1 | 0 | 16.6 | 1.39 | 5 | | |
| 584001 | 004W | 1 | 0 | 16.8 | 1.64 | 5 | | |
| 584001 | 004W | 1 | 0 | 17.0 | 1.51 | 6 | | |
| 584001 | 004W | 1 | 0 | 18.1 | 1.89 | No scale | | |
| 584001 | 004W | 1 | 0 | 23.3 | 3.18 | 6 | | |
| 584001 | 004W | 2 | 0 | 4.8 | .04 | 1 | | |
| 584001 | 004W | 2 | 0 | 9.4 | .26 | 2 | | |
| 584001 | 004W | 2 | 0 | 10.1 | .34 | 3 | | |
| 584001 | 004W | 2 | 0 | 10.3 | .34 | 3 | | |

MUSSELHELL RIVER WINNECOCK 7100 FEET
 COLLECTION 584001 004W BROWN TROUT MARKED 04/12/84

| COLLECTION | SPECIES | TRIP | MARK | LENGTH | WEIGHT | AGE | SEX | OTHER |
|------------|---------|------|------|--------|--------|----------|-----|-------|
| 584001 | 004W | 2 | 0 | 10.5 | .35 | 3 | | |
| 584001 | 004W | 2 | 0 | 10.6 | .43 | 3 | | |
| 584001 | 004W | 2 | 0 | 10.7 | .42 | 3 | | |
| 584001 | 004W | 2 | 0 | 10.8 | .40 | 4 | | |
| 584001 | 004W | 2 | 0 | 10.8 | .45 | 3 | | |
| 584001 | 004W | 2 | 0 | 11.0 | .50 | 3 | | |
| 584001 | 004W | 2 | 0 | 11.6 | .47 | 4 | | |
| 584001 | 004W | 2 | 0 | 11.9 | .50 | 3 | | |
| 584001 | 004W | 2 | 0 | 11.9 | .54 | 4 | | |
| 584001 | 004W | 2 | 0 | 12.0 | .59 | 3 | | |
| 584001 | 004W | 2 | 0 | 12.7 | .70 | 4 | | |
| 584001 | 004W | 2 | 0 | 12.8 | .63 | 4 | | |
| 584001 | 004W | 2 | 0 | 12.9 | .64 | 4 | | |
| 584001 | 004W | 2 | 0 | 13.2 | .71 | 4 | | |
| 584001 | 004W | 2 | 0 | 13.2 | .74 | 4 | | |
| 584001 | 004W | 2 | 0 | 13.2 | .77 | No scale | | |
| 584001 | 004W | 2 | 0 | 13.4 | .74 | 4 | | |
| 584001 | 004W | 2 | 0 | 13.5 | .81 | 4 | | |
| 584001 | 004W | 2 | 0 | 13.8 | .76 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.0 | .83 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.4 | .89 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.5 | 1.10 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.6 | .98 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.7 | 1.00 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.7 | 1.03 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.8 | 1.01 | 4 | | |
| 584001 | 004W | 2 | 0 | 14.9 | 1.08 | 4 | | |
| 584001 | 004W | 2 | 0 | 16.4 | 1.44 | 4 | | |
| 584001 | 004W | 2 | 0 | 17.0 | 1.68 | 5 | | |
| 584001 | 004W | 2 | 1 | 4.3 | | | | |
| 584001 | 004W | 2 | 1 | 10.2 | | | | |
| 584001 | 004W | 2 | 1 | 12.0 | | | | |
| 584001 | 004W | 2 | 1 | 12.3 | | | | |
| 584001 | 004W | 2 | 1 | 13.2 | | | | |
| 584001 | 004W | 2 | 1 | 13.5 | | | | |
| 584001 | 004W | 2 | 1 | 13.9 | | | | |
| 584001 | 004W | 2 | 1 | 14.4 | | | | |
| 584001 | 004W | 2 | 1 | 14.5 | | | | |
| 584001 | 004W | 2 | 1 | 14.9 | | | | |
| 584001 | 004W | 2 | 1 | 15.5 | | | | |
| 584001 | 004W | 2 | 1 | 15.5 | | | | |
| 584001 | 004W | 2 | 1 | 15.6 | | | | |

TOTAL M-R RECORDS 92

Codes: Trip type 1 = marking run
 Trip type 2 = recapture run
 Mark 0 = unmarked fish
 Mark 1 = marked fish

MONTANA DEPARTMENT OF FISH WILDLIFE & PARKS
 MARK-RECAPTURE EFFICIENCY
 MAY 10, 1984

MUSSELSHELL RIVER WINNECOCK
 COLLECTION 584001 004W BROWN TROUT

7100 FEE
 MARKED 04/12

| SIZE CLASS | M | C | R | R/C |
|-------------|----|----|----|------|
| 3.5 - 3.9 | 1 | 0 | 0 | 0% |
| 4.0 - 4.4 | 2 | 1 | 1 | 100% |
| 4.5 - 4.9 | 1 | 1 | 0 | 0% |
| 5.0 - 5.4 | 1 | 0 | 0 | 0% |
| 5.5 - 5.9 | 0 | 0 | 0 | 0% |
| 6.0 - 6.4 | 0 | 0 | 0 | 0% |
| 6.5 - 6.9 | 0 | 0 | 0 | 0% |
| 7.0 - 7.4 | 0 | 0 | 0 | 0% |
| 7.5 - 7.9 | 0 | 0 | 0 | 0% |
| 8.0 - 8.4 | 0 | 0 | 0 | 0% |
| 8.5 - 8.9 | 1 | 0 | 0 | 0% |
| 9.0 - 9.4 | 2 | 1 | 0 | 0% |
| 9.5 - 9.9 | 2 | 0 | 0 | 0% |
| 10.0 - 10.4 | 5 | 3 | 1 | 33% |
| 10.5 - 10.9 | 0 | 5 | 0 | 0% |
| 11.0 - 11.4 | 0 | 1 | 0 | 0% |
| 11.5 - 11.9 | 1 | 3 | 0 | 0% |
| 12.0 - 12.4 | 4 | 3 | 2 | 67% |
| 12.5 - 12.9 | 1 | 3 | 0 | 0% |
| 13.0 - 13.4 | 2 | 5 | 1 | 20% |
| 13.5 - 13.9 | 6 | 4 | 2 | 50% |
| 14.0 - 14.4 | 6 | 3 | 1 | 33% |
| 14.5 - 14.9 | 2 | 8 | 2 | 25% |
| 15.0 - 15.4 | 0 | 0 | 0 | 0% |
| 15.5 - 15.9 | 4 | 3 | 3 | 100% |
| 16.0 - 16.4 | 0 | 1 | 0 | 0% |
| 16.5 - 16.9 | 2 | 0 | 0 | 0% |
| 17.0 - 17.4 | 1 | 1 | 0 | 0% |
| 17.5 - 17.9 | 0 | 0 | 0 | 0% |
| 18.0 - 18.4 | 1 | 0 | 0 | 0% |
| 18.5 - 18.9 | 0 | 0 | 0 | 0% |
| 19.0 - 19.4 | 0 | 0 | 0 | 0% |
| 19.5 - 19.9 | 0 | 0 | 0 | 0% |
| 20.0 - 20.4 | 0 | 0 | 0 | 0% |
| 20.5 - 20.9 | 0 | 0 | 0 | 0% |
| 21.0 - 21.4 | 0 | 0 | 0 | 0% |
| 21.5 - 21.9 | 0 | 0 | 0 | 0% |
| 22.0 - 22.4 | 0 | 0 | 0 | 0% |
| 22.5 - 22.9 | 0 | 0 | 0 | 0% |
| 23.0 - 23.4 | 1 | 0 | 0 | 0% |
| TOTAL | 46 | 46 | 13 | 28% |

M = marking run

C = recapture run

R = marked fish recaptured

USSELSHELL RIVER CK EAR FANCH 8300 FEET
 COLLECTION 584002 0J4W BROWN TROUT MARKED 04/13/84

| COLLECTION | SPECIES | TRIP | MARK | LENGTH | WEIGHT | AGE | SEX | OTHER |
|------------|---------|------|------|--------|--------|----------|-----|-------|
| 584002 | 004W | 1 | 0 | 3.6 | .05 | 1 | | |
| 584002 | 004W | 1 | 0 | 4.7 | .05 | 1 | | |
| 584002 | 004W | 1 | 0 | 4.8 | .04 | 1 | | |
| 584002 | 004W | 1 | 0 | 5.4 | .05 | 1 | | |
| 584002 | 004W | 1 | 0 | 8.4 | .20 | 2 | | |
| 584002 | 004W | 1 | 0 | 10.7 | .42 | 2 | | |
| 584002 | 004W | 1 | 0 | 10.9 | .40 | 2 | | |
| 584002 | 004W | 1 | 0 | 11.0 | .40 | 3 | | |
| 584002 | 004W | 1 | 0 | 12.9 | .71 | 3 | | |
| 584002 | 004W | 1 | 0 | 13.3 | .64 | 3 | | |
| 584002 | 004W | 1 | 0 | 13.4 | .80 | 4 | | |
| 584002 | 004W | 1 | 0 | 14.0 | .54 | 4 | | |
| 584002 | 004W | 1 | 0 | 14.5 | 1.08 | 4 | | |
| 584002 | 004W | 1 | 0 | 14.9 | .97 | No scale | | |
| 584002 | 004W | 1 | 0 | 14.9 | 1.22 | 4 | | |
| 584002 | 004W | 1 | 0 | 15.3 | 1.23 | 4 | | |
| 584002 | 004W | 1 | 0 | 15.3 | 1.42 | 4 | | |
| 584002 | 004W | 1 | 0 | 15.4 | 1.14 | 4 | | |
| 584002 | 004W | 1 | 0 | 15.9 | 1.40 | 4 | | |
| 584002 | 004W | 1 | 0 | 20.0 | 2.76 | 5 | | |
| 584002 | 004W | 1 | 0 | 23.5 | 5.25 | 6 | | |
| 584002 | 004W | 2 | 0 | 4.6 | .04 | 1 | | |
| 584002 | 004W | 2 | 0 | 4.9 | .05 | 1 | | |
| 584002 | 004W | 2 | 0 | 10.7 | .37 | 2 | | |
| 584002 | 004W | 2 | 0 | 10.9 | .36 | 2 | | |
| 584002 | 004W | 2 | 0 | 12.6 | .60 | 3 | | |
| 584002 | 004W | 2 | 0 | 12.8 | .69 | 3 | | |
| 584002 | 004W | 2 | 0 | 13.2 | .78 | No scale | | |
| 584002 | 004W | 2 | 0 | 13.8 | .85 | 4 | | |
| 584002 | 004W | 2 | 0 | 15.5 | 1.30 | 4 | | |
| 584002 | 004W | 2 | 1 | 8.3 | | | | |
| 584002 | 004W | 2 | 1 | 13.3 | | | | |
| 584002 | 004W | 2 | 1 | 14.1 | | | | |
| 584002 | 004W | 2 | 1 | 14.9 | | | | |
| 584002 | 004W | 2 | 1 | 16.0 | | | | |

TOTAL M-R RECCROS 35

MONTANA DEPARTMENT OF FISH WILDLIFE & PARKS
 MARK-RECAPTURE EFFICIENCY
 MAY 10, 1984

RPT 1189.3

PAGE

MUSSELSHELL RIVER OK EAR RANCH
 COLLECTION S84002 C04W BROWN TROUT

8300 FEET
 MARKED 04/13

| SIZE CLASS | M | C | R | R/C |
|-------------|----|----|---|------|
| 3.5 - 3.9 | 1 | 0 | 0 | 0% |
| 4.0 - 4.4 | 0 | 0 | 0 | 0% |
| 4.5 - 4.9 | 2 | 2 | 0 | 0% |
| 5.0 - 5.4 | 1 | 0 | 0 | 0% |
| 5.5 - 5.9 | 0 | 0 | 0 | 0% |
| 6.0 - 6.4 | 0 | 0 | 0 | 0% |
| 6.5 - 6.9 | 0 | 0 | 0 | 0% |
| 7.0 - 7.4 | 0 | 0 | 0 | 0% |
| 7.5 - 7.9 | 0 | 0 | 0 | 0% |
| 8.0 - 8.4 | 1 | 1 | 1 | 100% |
| 8.5 - 8.9 | 0 | 0 | 0 | 0% |
| 9.0 - 9.4 | 0 | 0 | 0 | 0% |
| 9.5 - 9.9 | 0 | 0 | 0 | 0% |
| 10.0 - 10.4 | 0 | 0 | 0 | 0% |
| 10.5 - 10.9 | 2 | 2 | 0 | 0% |
| 11.0 - 11.4 | 1 | 0 | 0 | 0% |
| 11.5 - 11.9 | 0 | 0 | 0 | 0% |
| 12.0 - 12.4 | 0 | 0 | 0 | 0% |
| 12.5 - 12.9 | 1 | 2 | 0 | 0% |
| 13.0 - 13.4 | 2 | 2 | 1 | 50% |
| 13.5 - 13.9 | 0 | 1 | 0 | 0% |
| 14.0 - 14.4 | 1 | 1 | 1 | 100% |
| 14.5 - 14.9 | 3 | 1 | 1 | 100% |
| 15.0 - 15.4 | 3 | 0 | 0 | 0% |
| 15.5 - 15.9 | 1 | 1 | 0 | 0% |
| 16.0 - 16.4 | 0 | 1 | 1 | 100% |
| 16.5 - 16.9 | 0 | 0 | 0 | 0% |
| 17.0 - 17.4 | 0 | 0 | 0 | 0% |
| 17.5 - 17.9 | 0 | 0 | 0 | 0% |
| 18.0 - 18.4 | 0 | 0 | 0 | 0% |
| 18.5 - 18.9 | 0 | 0 | 0 | 0% |
| 19.0 - 19.4 | 0 | 0 | 0 | 0% |
| 19.5 - 19.9 | 0 | 0 | 0 | 0% |
| 20.0 - 20.4 | 1 | 0 | 0 | 0% |
| 20.5 - 20.9 | 0 | 0 | 0 | 0% |
| 21.0 - 21.4 | 0 | 0 | 0 | 0% |
| 21.5 - 21.9 | 0 | 0 | 0 | 0% |
| 22.0 - 22.4 | 0 | 0 | 0 | 0% |
| 22.5 - 22.9 | 0 | 0 | 0 | 0% |
| 23.0 - 23.4 | 0 | 0 | 0 | 0% |
| 23.5 - 23.9 | 1 | 0 | 0 | 0% |
| TOTAL | 21 | 14 | 5 | 36% |

MONTANA DEPARTMENT OF FISH WILDLIFE & PARKS
 FISH POPULATION MARK-RECAPTURE DATA
 MAY 10, 1984

MUSSELSHELL RIVER BARBER 6700 FEET
 COLLECTION 584003 0J4W BROWN TROUT MARKED 04/11/84

| COLLECTION | SPECIES | TRIP | MARK | LENGTH | WEIGHT | AGE | SEX | OTHER |
|------------|---------|------|------|--------|--------|----------|-----|-------|
| 584003 | 004W | 1 | 0 | 10.7 | .41 | 2 | | |
| 584003 | 004W | 1 | 0 | 12.4 | .64 | 4 | | |
| 584003 | 004W | 1 | 0 | 13.4 | .92 | 4 | | |
| 584003 | 004W | 1 | 0 | 13.5 | 1.00 | 5 | | |
| 584003 | 004W | 1 | 0 | 13.7 | .92 | 4 | | |
| 584003 | 004W | 1 | 0 | 14.3 | 1.09 | 4 | | |
| 584003 | 004W | 1 | 0 | 14.9 | 1.18 | 4 | | |
| 584003 | 004W | 1 | 0 | 15.0 | 1.16 | 5 | | |
| 584003 | 004W | 1 | 0 | 15.3 | 1.24 | 5 | | |
| 584003 | 004W | 1 | 0 | 15.6 | 1.40 | 4 | | |
| 584003 | 004W | 1 | 0 | 16.6 | 1.71 | 5 | | |
| 584003 | 004W | 2 | 0 | 5.4 | .05 | 1 | | |
| 584003 | 004W | 2 | 0 | 11.0 | .47 | 2 | | |
| 584003 | 004W | 2 | 0 | 12.0 | .60 | 3 | | |
| 584003 | 004W | 2 | 0 | 13.0 | .68 | 4 | | |
| 584003 | 004W | 2 | 0 | 13.2 | .79 | 4 | | |
| 584003 | 0J4W | 2 | 0 | 13.2 | .83 | 4 | | |
| 584003 | 004W | 2 | 0 | 13.4 | .77 | 4 | | |
| 584003 | 004W | 2 | 0 | 13.5 | .87 | 4 | | |
| 584003 | 004W | 2 | 0 | 14.2 | .99 | 4 | | |
| 584003 | 004W | 2 | 0 | 14.2 | 1.00 | 4 | | |
| 584003 | 004W | 2 | 0 | 14.2 | 1.10 | No scale | | |
| 584003 | 004W | 2 | 0 | 14.3 | 1.10 | No scale | | |
| 584003 | 004W | 2 | 0 | 14.8 | 1.18 | 4 | | |
| 584003 | 004W | 2 | 0 | 16.0 | 1.54 | 4 | | |
| 584003 | 004W | 2 | 1 | 13.7 | | | | |
| 584003 | 004W | 2 | 1 | 15.6 | | | | |
| 584003 | 004W | 2 | 1 | 15.6 | | | | |
| 584003 | 004W | 2 | 1 | 16.9 | | | | |

TOTAL M-R RECORDS 29

MUSSEL-SHELL RIVER BARBER
COLLECTION S84003 004W BROWN TROUT6700 FEET
MARKED 04/11/74

| SIZE CLASS | M | C | R | R/C |
|-------------|----|----|---|------|
| 5.0 - 5.4 | 0 | 1 | 0 | 0% |
| 5.5 - 5.9 | 0 | 0 | 0 | 0% |
| 6.0 - 6.4 | 0 | 0 | 0 | 0% |
| 6.5 - 6.9 | 0 | 0 | 0 | 0% |
| 7.0 - 7.4 | 0 | 0 | 0 | 0% |
| 7.5 - 7.9 | 0 | 0 | 0 | 0% |
| 8.0 - 8.4 | 0 | 0 | 0 | 0% |
| 8.5 - 8.9 | 0 | 0 | 0 | 0% |
| 9.0 - 9.4 | 0 | 0 | 0 | 0% |
| 9.5 - 9.9 | 0 | 0 | 0 | 0% |
| 10.0 - 10.4 | 0 | 0 | 0 | 0% |
| 10.5 - 10.9 | 1 | 0 | 0 | 0% |
| 11.0 - 11.4 | 0 | 1 | 0 | 0% |
| 11.5 - 11.9 | 0 | 0 | 0 | 0% |
| 12.0 - 12.4 | 1 | 1 | 0 | 0% |
| 12.5 - 12.9 | 0 | 0 | 0 | 0% |
| 13.0 - 13.4 | 1 | 4 | 0 | 0% |
| 13.5 - 13.9 | 2 | 2 | 1 | 50% |
| 14.0 - 14.4 | 1 | 4 | 0 | 0% |
| 14.5 - 14.9 | 1 | 1 | 0 | 0% |
| 15.0 - 15.4 | 2 | 0 | 0 | 0% |
| 15.5 - 15.9 | 1 | 2 | 2 | 100% |
| 16.0 - 16.4 | 0 | 1 | 0 | 0% |
| 16.5 - 16.9 | 1 | 1 | 1 | 100% |
| TOTAL | 11 | 18 | 4 | 22% |

MUSSEL SHELL RIVER
COLLECTION 584001 004W BROWN TROUT

7100 FEET
MARKED 04/12/64

| LENGTH GROUP | M | C | R | NUMBER ESTIMATE | 1.282 ST DEV | WEIGHT ESTIMATE | 1.282 ST DEV | CF 5-INCH AND OVER | 1.282 ST DEV |
|------------------|----|----|----|-----------------|--------------|-----------------|--------------|--------------------|--------------|
| 3.0 - 23.3 | 46 | 40 | 13 | 157 | 37 | 110 | 28 | 32.72 | 3.59 |
| TOTAL OR AVERAGE | 46 | 40 | 13 | 157 | 37 | 112 | 28 | 32.72 | 3.59 |

M-R RECORDS INPUT
NEW FISH USED 92
RECAPTURES USED 79
LENGTHS UNUSABLE 13
RECORDS INVALID 0

MUSSELHELL RIVER
COLLECTION 584001 004W WINNECOCK
BROWN TROUT

7100 FEET
MARKED 04/12/84

| INTERVAL | ESTIMATED NUMBER | ESTIMATED WEIGHT | CONDITION FACTOR |
|-------------|------------------|------------------|------------------|
| 3.50-3.99 | 2 | 0 | 64.50 |
| 4.00-4.49 | 4 | 0 | 59.01 |
| 4.50-4.99 | 4 | 0 | 37.35 |
| 5.00-5.49 | 2 | 0 | 33.56 |
| 5.50-5.99 | 0 | 0 | 0.00 |
| 6.00-6.49 | 0 | 0 | 0.00 |
| 6.50-6.99 | 0 | 0 | 0.00 |
| 7.00-7.49 | 0 | 0 | 0.00 |
| 7.50-7.99 | 0 | 0 | 0.00 |
| 8.00-8.49 | 0 | 0 | 0.00 |
| 8.50-8.99 | 2 | 0 | 0.00 |
| 9.00-9.49 | 6 | 2 | 35.52 |
| 9.50-9.99 | 4 | 1 | 31.84 |
| 10.00-10.49 | 14 | 5 | 31.83 |
| 10.50-10.99 | 10 | 4 | 31.92 |
| 11.00-11.49 | 2 | 1 | 35.62 |
| 11.50-11.99 | 8 | 4 | 37.57 |
| 12.00-12.49 | 10 | 6 | 31.12 |
| 12.50-12.99 | 8 | 5 | 35.81 |
| 13.00-13.49 | 12 | 9 | 31.44 |
| 13.50-13.99 | 16 | 13 | 32.69 |
| 14.00-14.49 | 16 | 13 | 31.92 |
| 14.50-14.99 | 16 | 17 | 33.56 |
| 15.00-15.49 | 0 | 0 | 32.91 |
| 15.50-15.99 | 8 | 10 | 0.00 |
| 16.00-16.49 | 2 | 3 | 32.96 |
| 16.50-16.99 | 4 | 6 | 32.65 |
| 17.00-17.49 | 4 | 6 | 32.49 |
| 17.50-17.99 | 0 | 0 | 32.46 |
| 18.00-18.49 | 2 | 4 | 0.00 |
| 18.50-18.99 | 0 | 0 | 31.57 |
| 19.00-19.49 | 0 | 0 | 0.00 |
| 19.50-19.99 | 0 | 0 | 0.00 |
| 20.00-20.49 | 0 | 0 | 0.00 |
| 20.50-20.99 | 0 | 0 | 0.00 |
| 21.00-21.49 | 0 | 0 | 0.00 |
| 21.50-21.99 | 0 | 0 | 0.00 |
| 22.00-22.49 | 0 | 0 | 0.00 |
| 22.50-22.99 | 0 | 0 | 0.00 |
| 23.00-23.49 | 2 | 0 | 25.14 |
| TOTAL | 157 | 118 | 33.53 |

MUSSELSHELL RIVER
COLLECTION 584001

7100 FEET
MARKED 04/12/64

004W BROWN FRUIT

| | .0 | .1 | .2 | .3 | .4 | .5 | .6 | .7 | .8 | .9 |
|----|------|------|------|------|------|------|------|------|------|------|
| 3 | | | | | | | | | | |
| 4 | | 0.04 | 0.04 | | | | | 0.04 | 0.04 | |
| 5 | | | | 0.05 | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | 0.22 | | | | |
| 9 | 0.24 | | | | 0.20 | | | | | 0.31 |
| 10 | | 0.34 | 0.35 | 0.34 | 0.35 | 0.35 | 0.43 | 0.42 | 0.43 | |
| 11 | 0.50 | | | | | | 0.47 | | | 0.53 |
| 12 | 0.58 | | | 0.71 | 0.70 | | | 0.68 | 0.63 | 0.64 |
| 13 | | | 0.70 | | 0.78 | 0.83 | 0.77 | | 0.76 | 0.98 |
| 14 | 0.90 | | 1.05 | 1.06 | 0.89 | 1.05 | 0.93 | 1.02 | 1.08 | 1.08 |
| 15 | | | | | | 1.23 | | | | |
| 16 | 1.60 | | | | 1.44 | | 1.59 | | 1.64 | |
| 17 | | | | | | | | | | |
| 18 | | 1.89 | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | | | | 3.18 | | | | | | |

MONTANA DEPARTMENT OF FISH WILDLIFE & PARKS
 FISH POPULATION STATISTICS BY LENGTH GROUP
 MAY 30, 1984

MUSSELSHELL RIVER
 COLLECTION 584002 004W GROWN TROUT

8300 FEET
 MARKED 04/13/84

| LENGTH GROUP | M | C | K | NUMBER ESTIMATE | 1.282 ST DEV | WEIGHT ESTIMATE | 1.282 ST DEV | CF 5-INCH AND OVER | 1.282 ST DEV |
|------------------|----|----|---|-----------------|--------------|-----------------|--------------|--------------------|--------------|
| 3.6 - 23.5 | 21 | 14 | 5 | 54 | 18 | 47 | 15 | 33.09 | 4.10 |
| TOTAL OR AVERAGE | 21 | 14 | 5 | 54 | 18 | 47 | 15 | 33.09 | 4.10 |

M-K RECORDS INPUT 35
 NEW FISH USED 30
 CAPTURES USED 5
 LENGTHS UNUSABLE 0
 RECORDS INVALID 0

MUSSEL-SHELL RIVER UK BAR RANCH
 COLLECTION 584002 004W BROWN TROUT MARKED 04/13/84

| INTERVAL | ESTIMATED NUMBER | ESTIMATED WEIGHT | CONDITION FACTOR |
|-------------|------------------|------------------|------------------|
| 3.50- 3.99 | 2 | 0 | 107.17 |
| 4.00- 4.49 | 0 | 0 | 0.00 |
| 4.50- 4.99 | 7 | 0 | 41.98 |
| 5.00- 5.49 | 2 | 0 | 31.75 |
| 5.50- 5.99 | 0 | 0 | 0.00 |
| 6.00- 6.49 | 0 | 0 | 0.00 |
| 6.50- 6.99 | 0 | 0 | 0.00 |
| 7.00- 7.49 | 0 | 0 | 0.00 |
| 7.50- 7.99 | 0 | 0 | 0.00 |
| 8.00- 8.49 | 2 | 0 | 33.74 |
| 8.50- 8.99 | 0 | 0 | 0.00 |
| 9.00- 9.49 | 0 | 0 | 0.00 |
| 9.50- 9.99 | 0 | 0 | 0.00 |
| 10.00-10.49 | 0 | 0 | 0.00 |
| 10.50-10.99 | 7 | 3 | 30.79 |
| 11.00-11.49 | 2 | 1 | 30.05 |
| 11.50-11.99 | 0 | 0 | 0.00 |
| 12.00-12.49 | 0 | 0 | 0.00 |
| 12.50-12.99 | 5 | 4 | 31.99 |
| 13.00-13.49 | 2 | 4 | 31.46 |
| 13.50-13.99 | 2 | 2 | 32.34 |
| 14.00-14.49 | 2 | 2 | 34.26 |
| 14.50-14.99 | 5 | 6 | 33.88 |
| 15.00-15.49 | 5 | 7 | 35.07 |
| 15.50-15.99 | 4 | 5 | 34.87 |
| 16.00-16.49 | 0 | 0 | 0.00 |
| 16.50-16.99 | 0 | 0 | 0.00 |
| 17.00-17.49 | 0 | 0 | 0.00 |
| 17.50-17.99 | 0 | 0 | 0.00 |
| 18.00-18.49 | 0 | 0 | 0.00 |
| 18.50-18.99 | 0 | 0 | 0.00 |
| 19.00-19.49 | 0 | 0 | 0.00 |
| 19.50-19.99 | 0 | 0 | 0.00 |
| 20.00-20.49 | 2 | 2 | 34.50 |
| 20.50-20.99 | 0 | 0 | 0.00 |
| 21.00-21.49 | 0 | 0 | 0.00 |
| 21.50-21.99 | 0 | 0 | 0.00 |
| 22.00-22.49 | 0 | 0 | 0.00 |
| 22.50-22.99 | 0 | 0 | 0.00 |
| 23.00-23.49 | 0 | 0 | 0.00 |
| 23.50-23.99 | 2 | 9 | 40.45 |
| TOTAL | 54 | 47 | 36.74 |

MUSSELSHELL RIVER
COLLECTION 584003

004W BROWN TROUT

BARBER

6700 FEET
MARKED 04/11/64

| LENGTH GROUP | M | C | R | NUMBER ESTIMATE | 1.282 ST DEV | WEIGHT ESTIMATE | 1.282 ST DEV | CF 3-INCH AND OVER | 1.282 ST DEV |
|---------------------|----|----|---|--------------------|-----------------|--------------------|-----------------|-----------------------|-----------------|
| 5.0 - 10.9 | 11 | 16 | 4 | 45 | 16 | 42 | 15 | 35.52 | 2.88 |
| TOTAL OR AVERAGE | 11 | 16 | 4 | 45 | 16 | 42 | 15 | 35.52 | 2.88 |

M-R RECORDS INPUT 29
NEW FISH USED 25
RECAPTURES USED 4
LENGTHS UNUSABLE 0
RECORDS INVALID 0

MUSSELSHELL RIVER BARBER
 COLLECTION 564003 004W BROWN TROUT

8700 FEET
 MARKED 04/11/64

| INTERVAL | ESTIMATED NUMBER | ESTIMATED WEIGHT | CONDITION FACTOR |
|-------------|------------------|------------------|------------------|
| 5.00-5.49 | 2 | 0 | 31.75 |
| 5.50-5.99 | 0 | 0 | 0.00 |
| 6.00-6.49 | 0 | 0 | 0.00 |
| 6.50-6.99 | 0 | 0 | 0.00 |
| 7.00-7.49 | 0 | 0 | 0.00 |
| 7.50-7.99 | 0 | 0 | 0.00 |
| 8.00-8.49 | 0 | 0 | 0.00 |
| 8.50-8.99 | 0 | 0 | 0.00 |
| 9.00-9.49 | 0 | 0 | 0.00 |
| 9.50-9.99 | 0 | 0 | 0.00 |
| 10.00-10.49 | 0 | 0 | 0.00 |
| 10.50-10.99 | 2 | 1 | 33.47 |
| 11.00-11.49 | 2 | 1 | 35.31 |
| 11.50-11.99 | 0 | 0 | 0.00 |
| 12.00-12.49 | 4 | 2 | 34.14 |
| 12.50-12.99 | 0 | 0 | 0.00 |
| 13.00-13.49 | 3 | 7 | 34.33 |
| 13.50-13.99 | 5 | 5 | 37.26 |
| 14.00-14.49 | 5 | 9 | 36.56 |
| 14.50-14.99 | 4 | 4 | 36.04 |
| 15.00-15.49 | 4 | 4 | 34.50 |
| 15.50-15.99 | 2 | 2 | 36.88 |
| 16.00-16.49 | 2 | 3 | 37.60 |
| 16.50-16.99 | 2 | 3 | 37.38 |
| TOTAL | 45 | 42 | 35.52 |

